

CHAPTER 5 – CAPACITY ANALYSIS

5.1 Introduction

A capacity analysis was conducted to measure how well the existing facilities and components associated with Washington airports accommodate aviation activity in the state. Existing airport capacity in Washington was first measured against current (2014) levels of aviation demand. Then the existing airport capacity in Washington was measured against forecast levels of aviation demand, identifying potential capacity constraints or shortfalls across the state through 2034.

Three types of airport capacity were examined as part of the capacity analysis:

- **Airfield Capacity:** The ability of an airport's runway system to accommodate takeoffs and landings without experiencing delays.
- **Aircraft Storage and Parking:** The ability of an airport to accommodate storage of based aircraft in tiedowns and hangars.
- **Air Cargo:** The ability of an airport to accommodate processing of air cargo tonnage using existing facilities.

Topics such as airport parking, TSA screening, baggage handling, off-airport road networks, and similar topics are outside the scope of this study and are addressed in airport master plans or local jurisdiction plans.

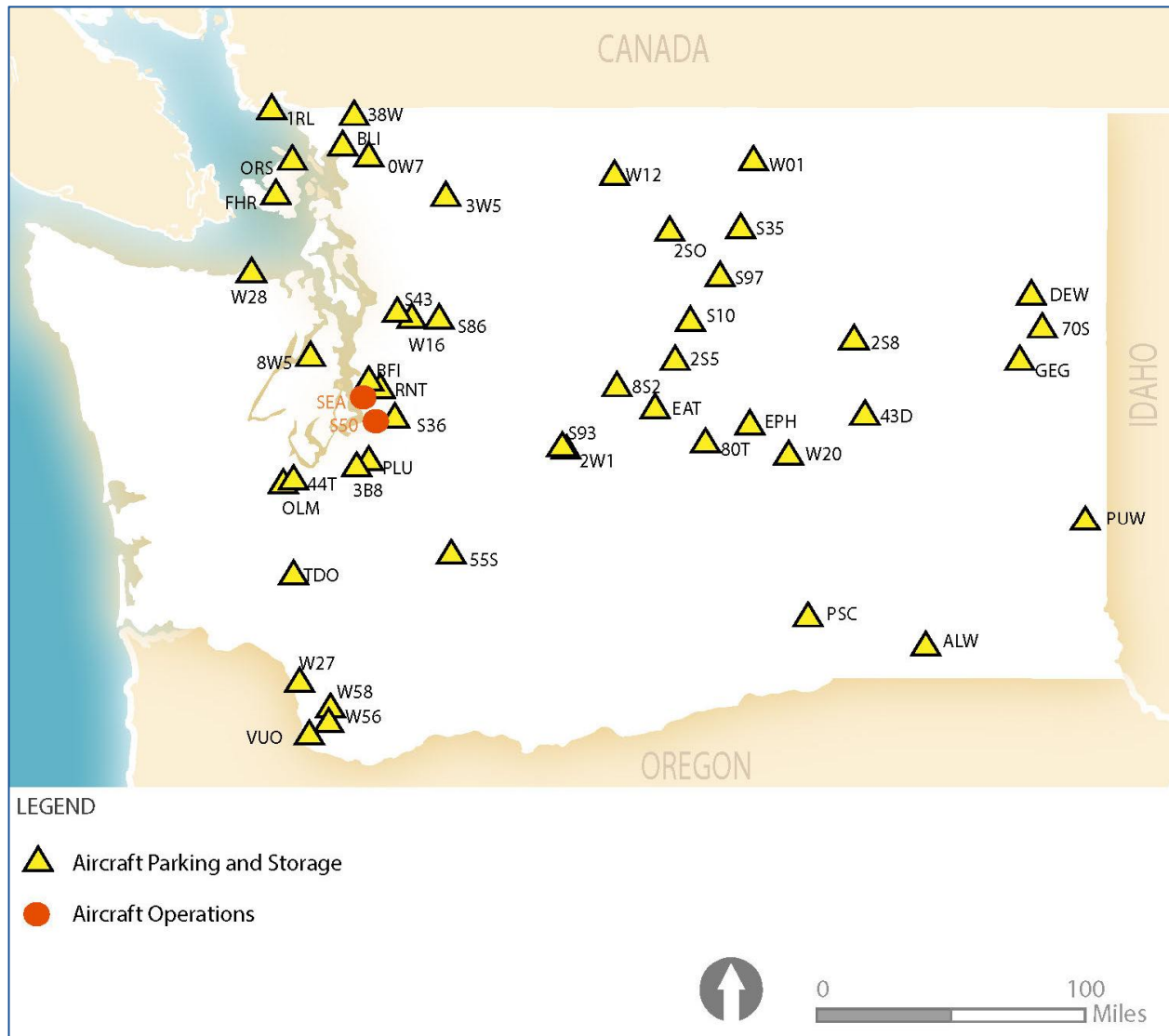
A number of airports across Washington are expected to experience either airfield or aircraft storage capacity constraints by 2034. These airports are shown in Figure 5-1 and identified in the following capacity discussions.

5.2 Airfield Capacity

It is important for the airport system to provide sufficient airfield operational capacity to accommodate current and future demand levels and provide efficient operations throughout the state. By comparing the annual operational demand to an airport's airfield capacity, each airport's current and forecasted demand/capacity ratio is established. This level of evaluation is appropriate for system planning needs, but it is important to note that for most large commercial airports and even some more active general aviation airports, capacity should be evaluated based on hourly conditions and not annual activity.

To examine annual capacity, each airport's annual service volume (ASV) was calculated. ASV is a measure of an airport's ability to process annual operational activity based on airport characteristics, such as airfield configuration and fleet mix. Each airport's ASV was either calculated using the methodologies contained in FAA AC 150/5060-5, *Airport Capacity and Delay*, or obtained from a recent airport master plan. While Seattle-Tacoma International Airport (SEA) was included at this level of analysis as part of the WASP, SEA calculates capacity and demand on an hourly basis (not annual) for its planning purposes in determining needed capacity improvements at the airport.

Figure 5-1: Washington Airports Expected to Approach or Exceed 100-Percent Capacity by 2034



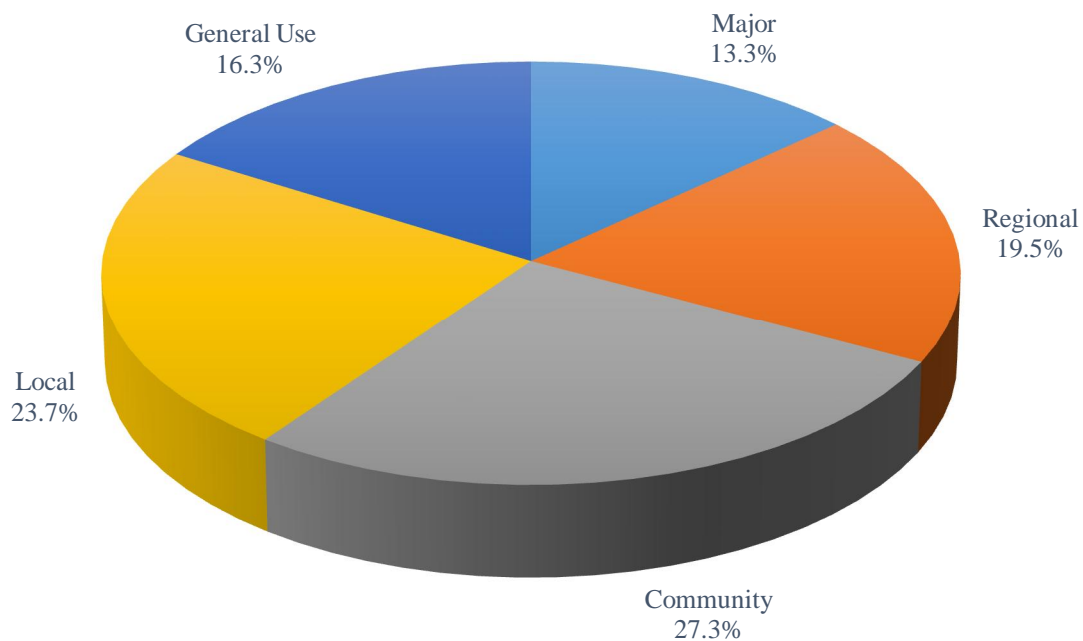
While it is possible for an airport to operate beyond its calculated ASV, aircraft delays will increase as the number of operations rise above the ASV. As delays grow, so do the operating costs of the airlines and aircraft owners, as well as the cost for airport operators. Environmental impacts can also increase, with increased delays leading to increased air and noise pollution due to aircraft waiting to take off or land. Finally, there are potential repercussions for the state airport system capacity as a whole when any airport within the system suffers significant delays.

5.2.1 Serving Current Demand

The public use airports that contribute to statewide operations capacity range widely in size and role. Major and regional airports are typically capable of handling operations by high performance aircraft (airliners, corporate jets, and turboprops), while Community airports typically handle medium- to high-performance aircraft. Local and general use airports accommodate a range of small general aviation aircraft operations (twin- and single-engine aircraft).

A breakdown of 2014 statewide annual service volume operations capacity in Washington by airport service classification is presented in Figure 5-2. Community airports and local airports currently account for the largest portions of state system capacity at 27 percent and 24 percent, respectively. Major and regional airports together represent 33 percent, or approximately one-third of statewide capacity only.

Figure 5-2: 2014 Statewide Annual Service Volume Capacity by Airport Service Classification



Aircraft operations in the state in 2014 utilized approximately 14 percent of overall annual airfield operational capacity. As shown in Table 5-1, the highest utilization was associated with the major and regional airports, where 2014 operations represented 29.5 percent and 27.5 percent, respectively, of overall capacity. Operations at other airport classifications did not exceed 11 percent of overall operations capacity of each category.

Table 5-1: 2014 Operations as Percent of Current Capacity by Airport Service Classification

State Airport Classification	Annual Service Volume	2014 Operations	2014 Operations as % of ASV
Major	3,189,200	940,926	29.5%
Regional	4,675,000	1,286,943	27.5%
Community	6,555,000	707,362	10.8%
Local	5,692,500	212,285	3.7%
General Use	3,910,000	120,766	3.1%
Total System	24,021,700	3,268,282	13.6%

Source: WSP | Parsons Brinckerhoff

While current operations utilize a small percentage of overall state operations capacity, operations and demand are not uniformly distributed among all airports. Airports located in and around the major population and economic centers of Washington, for example, experience the greater demand. Individual airports may face capacity constraints, while other airports have significant excess capacity, a typical dynamic in all states.

The current demand analysis identified three Washington airports where 2014 operations exceeded 60 percent of the airport ASV. The Federal Aviation Administration (FAA) recommends that planning for additional capacity at an airport be initiated when airport operations reach 60 percent of airport capacity. These three airports are listed in Table 5-2. All three airports are located in the highly populated, economically robust Puget Sound region.

Table 5-2: Washington Airports Over 60 Percent Operations Capacity as of 2014

Airport Name	Annual Service Volume	2014 Operations	2014 Operations as % of ASV
Sea-Tac International	533,000	340,078	63.8%
Harvey Field	230,000	141,739	61.6%
Auburn Municipal	230,000	164,539	71.5%

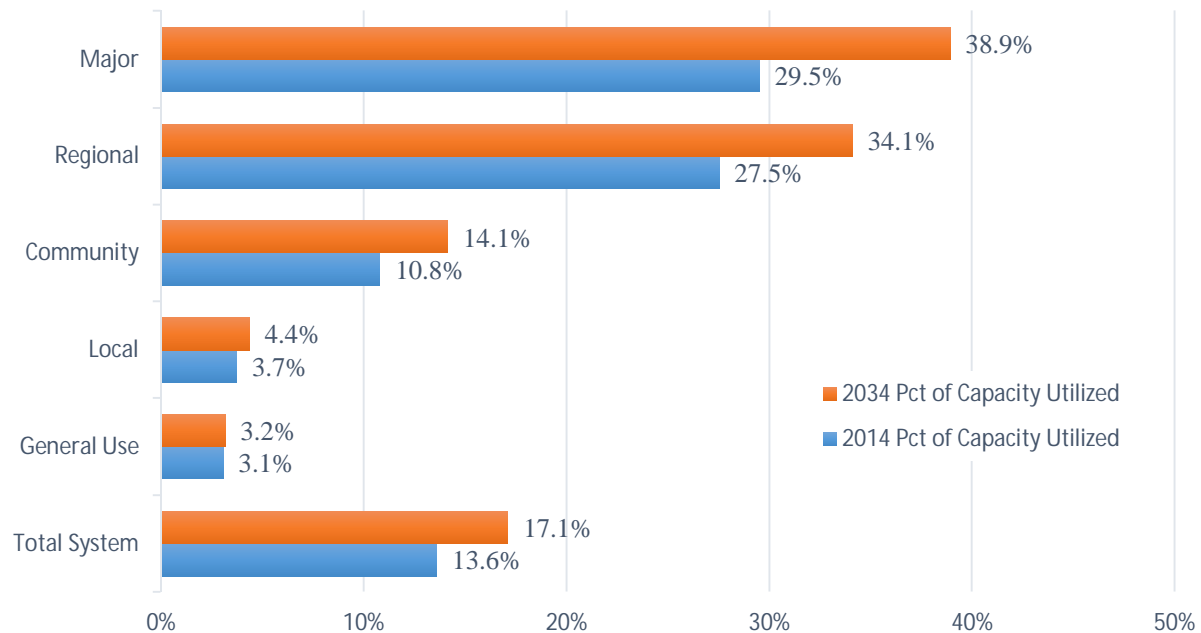
Source: WSP | Parsons Brinckerhoff

5.2.2 Serving Future Demand

Overall aircraft operations demand in Washington is forecast to increase from 13.6 percent of statewide capacity in 2014 to 17.1 percent of statewide capacity in 2034. The greatest operations demand will still

be associated with the major and regional airports, as shown in Figure 5-3. By 2034, utilization of overall operations capacity at major and regional airports will reach 39 percent and 34 percent, respectively.

Figure 5-3: 2014 vs. 2034 Aircraft Operations Demand/Capacity Utilization by Service Classification



While future aircraft operations activity remains well below the capacity of the aviation system when viewed from a statewide perspective, capacity constraints affect individual airports where demand is concentrated. Capacity constraints are expected to emerge at six airports in Washington by 2034.

SEA may exceed its airfield operating capacity by 2034 if its current ASV does not change in the future. SEA is currently updating its master plan, including an updated airfield capacity analysis. This analysis was not available at the time of publishing of this report.

Five other airports across the state, as shown in Table 5-3, are expected to reach or exceed 60 percent of operations capacity by 2034—the activity threshold at which planning for adding capacity should commence. The five airports include:

- Auburn Municipal
- Crest Airpark
- Ephrata Municipal
- Harvey Field
- Pierce County | Thun Field

Table 5-3: Airports with Anticipated Constraints in Aircraft Operational Capacity by 2034

Airport Name	ASV	2014 Operations	2014 Utilization	2034 Demand	2034 Utilization
Airports exceeding 100 percent capacity by 2034					
Sea-Tac International ¹	533,000	340,078	63.8%	550,700	103.3%
Airports exceeding 60 percent capacity by 2034					
Auburn Municipal	230,000	164,539	71.5%	220,700	96.0%
Ephrata Municipal	260,000	136,652	52.6%	177,500	68.3%
Harvey Field	230,000	141,739	61.6%	156,500	68.0%
Crest Airpark	230,000	113,880	49.5%	148,200	64.4%
Pierce County Thun Field	230,000	100,010	43.5%	144,400	62.8%

Source: WSP | Parsons Brinckerhoff

¹ Sea-Tac is currently updating its airport master plan, including an airfield capacity analysis.

The concentration of demand in the Puget Sound region in Washington constitutes the primary capacity issue for the state. Five airports within Puget Sound are expected to either approach or exceed their operation capacity by 2034, including SEA, the busiest airport in the state.

5.3 Aircraft Storage Capacity

Aircraft storage capacity at airports allows for general aviation aircraft to be stored in a location that is both safe and convenient when they are not in use. These general aviation aircraft based in the state are used for a wide variety of purposes, including corporate travel, emergency medical transportation, firefighting capabilities, and search and rescue support. Without adequate aircraft storage at Washington airports, aircraft operators may have difficulty serving particular communities and will not be able to operate in an efficient manner within the state system.

There are generally two types of aircraft storage available at airports: tiedowns and hangars. The decision to utilize either a hangar location or tiedown location is often due to personal preference or cost. Hangar facilities provide an added level of security and protection from the weather but have high leasing costs versus the use of a tiedown position, which have relatively low leasing costs. Larger hangar facilities are often used by corporate aviation to provide a location to base aircraft, conduct business, co-locate additional company services, and provide the regularly scheduled maintenance for aircraft.

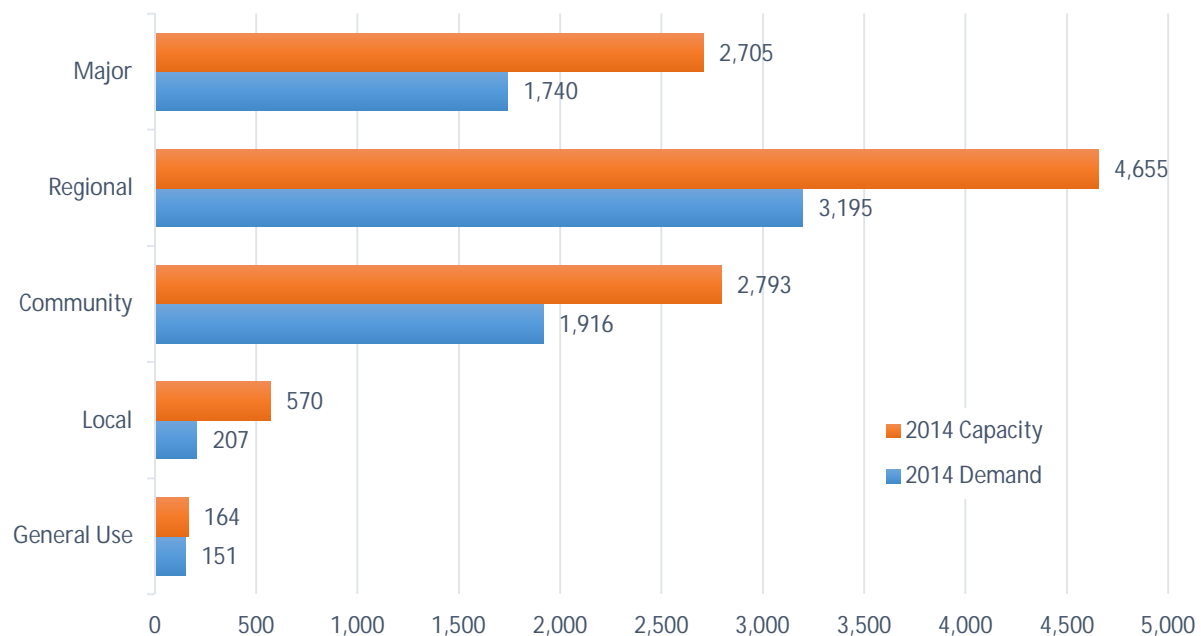
In addition to providing storage for based aircraft at Washington State airports, there is a substantial need for transient storage positions to accommodate visiting aircraft at these same airports. When aircraft fly from one airport to another in the course of completing business in the various communities, maintaining a ramp or apron to park an aircraft for several hours or multiple days is essential for support to aviation users. This is an additional consideration for future airport development.

5.3.1 Serving Current Demand

The existing aircraft storage capacity is comprised of both hangar buildings and aircraft tiedown positions at the public use airports across the state. As of 2014, aircraft storage capacity in Washington State totaled 10,887 positions, of which 3,183 were aircraft tiedown positions and 7,704 were hangar positions.¹

In 2014, the state airport system as a whole had reached 66 percent of its existing aircraft storage capacity. Aircraft storage at 21 system airports is currently at capacity. Figure 5-4 depicts the 2014 aircraft storage demand and capacity in Washington State by service classification. Figure 5-5 displays the 2014 storage demand and capacity analysis by airport. Table 5-4 displays the current aircraft storage shortfall by airport.

Figure 5-4: 2014 Washington State Aircraft Storage Demand vs. Capacity by Service Classification



¹ For the purposes of the aircraft storage capacity analysis, it was assumed that public and private large hangars identified in the inventory survey contained on average three aircraft storage positions.

Figure 5-5: 2014 Washington State Aircraft Storage Demand vs. Capacity

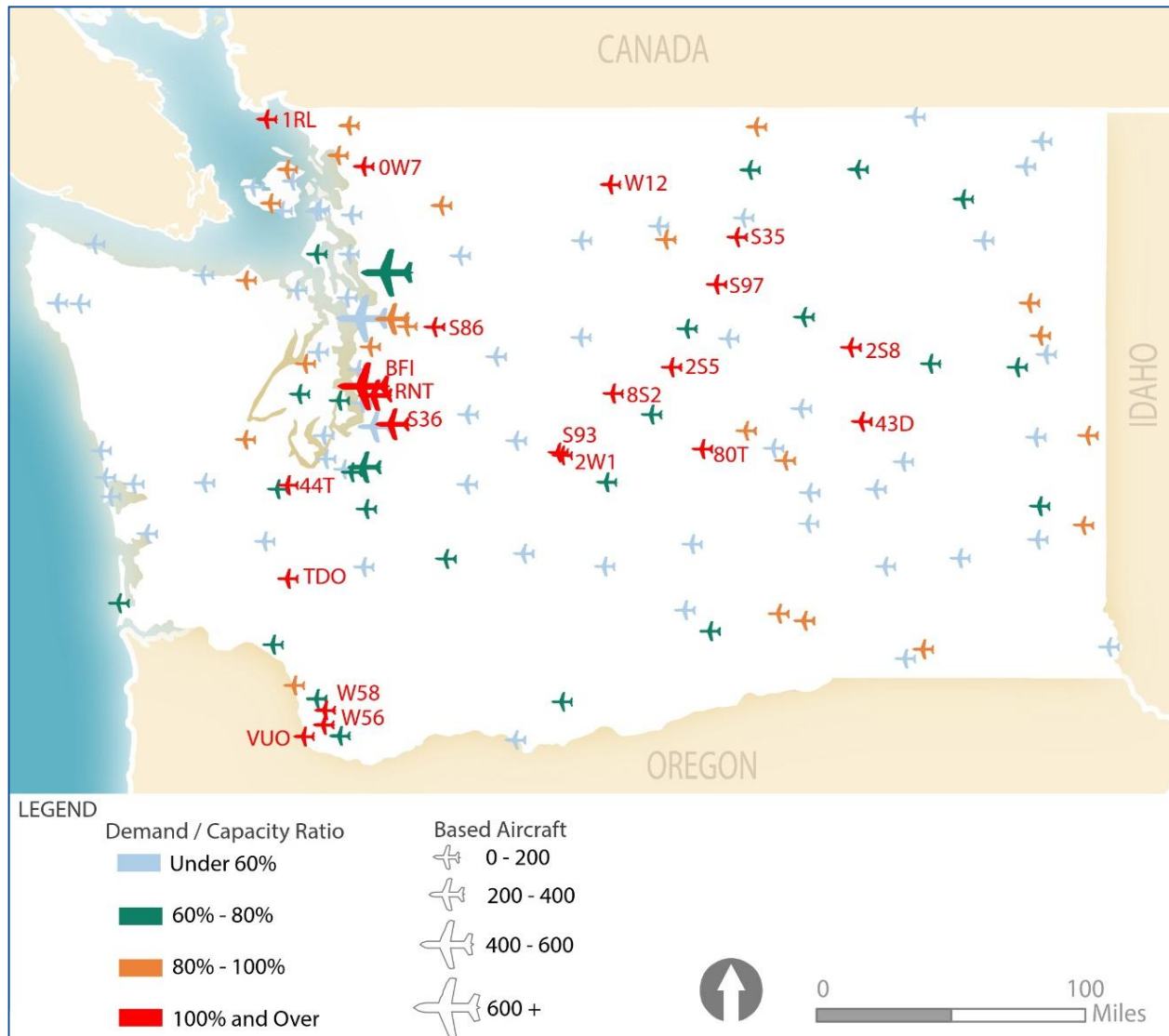


Table 5-4: 2014 Statewide Aircraft Storage Capacity Shortfall, by number of storage positions

Airport Name	Classification	Total 2014 Demand	2014 Capacity	2014 Shortfall
Crest Airpark	Community	332	233	-99
Cashmere Dryden	Community	50	36	-14
Ed Carlson Memorial – South Lewis County	Community	51	42	-9
Point Roberts Airpark	General Use	9	1	-8
Fly For Fun	General Use	12	6	-6
Cedars North Airpark	General Use	8	3	-5
Floathaven SPB	General Use	8	3	-5
Wilbur Municipal	Community	12	7	-5
Lost River	General Use	5	1	-4
Odessa Municipal	Local	11	7	-4
Anderson Field	Community	19	16	-3
Okanogan Legion	Community	18	17	-1
Boeing Field/King County International	Major	418	418	0
Cle Elum Municipal	Local	5	5	0
DeVere Field	Local	5	5	0
Hoskins Field	General Use	8	8	0
Pearson Field	Regional	171	171	0
Quincy Municipal	Local	6	6	0
Renton Municipal	Regional	358	358	0
Sky Harbor	General Use	3	3	0
Waterville	Local	13	13	0
Crest Airpark	Community	332	233	-99

Source: WSP / Parsons Brinckerhoff

5.3.2 Serving Future Demand

Aircraft parking and storage is generally constructed “on demand”; tiedown positions and aircraft hangars are typically only constructed as the demand occurs. Overall storage demand in Washington is forecast to increase by nearly 25 percent by 2034. The greatest increase in demand, on a percent-increase basis, is anticipated to be at community and major airports, increasing by 41.5 percent and 23.7 percent, respectively. Regional airports are anticipated to see increased demand of approximately 18 percent. Local and general use airports are forecast to see the least increase in demand, 2 percent and 3.3 percent, respectively.

Assuming no increase in 2014 aircraft storage capacity numbers, it is anticipated that the overall system would reach a utilization of nearly 83 percent by 2034. While the overall system is projected to have

long-term aircraft storage capacity, aircraft storage constraints are expected at individual airports in Washington. Approximately 35 percent (47 of 136) of Washington State airports are expected to have capacity shortfalls by 2034. Figure 5-6 depicts the 2034 aircraft storage demand and capacity in Washington State by service classification. Figure 5-7 displays the 2034 storage analysis by airport. Table 5-5 displays the anticipated aircraft storage shortfall by airport.

Figure 5-6: 2034 Washington State Aircraft Storage Demand vs. Capacity by Service Classification

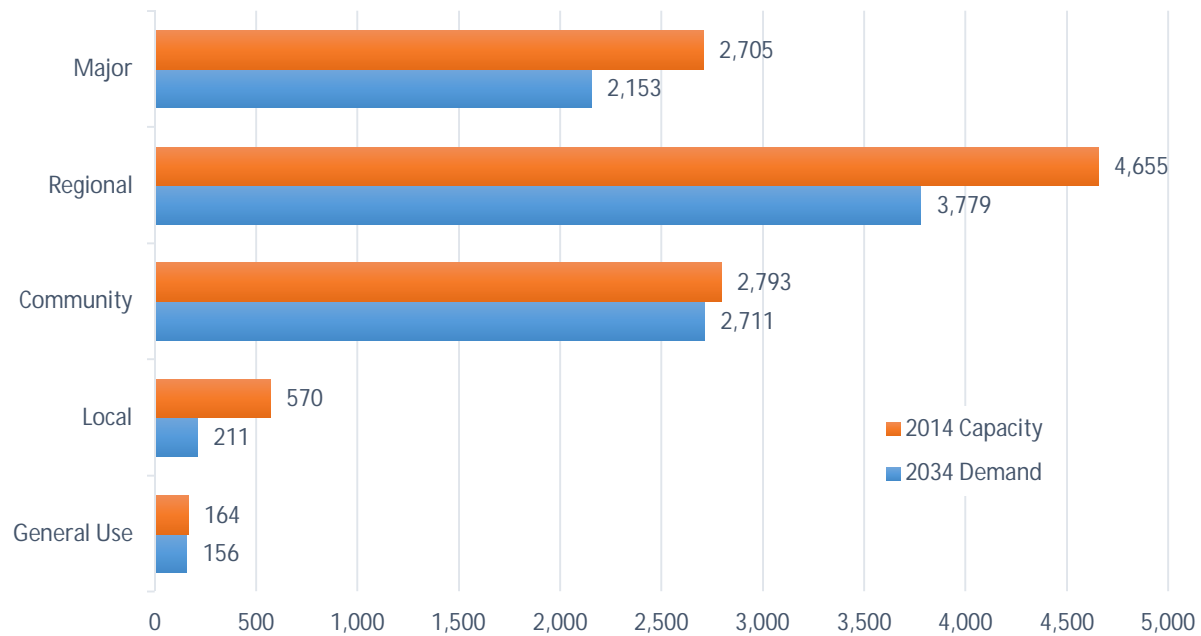


Figure 5-7: 2034 Washington State Aircraft Storage Demand vs. Capacity

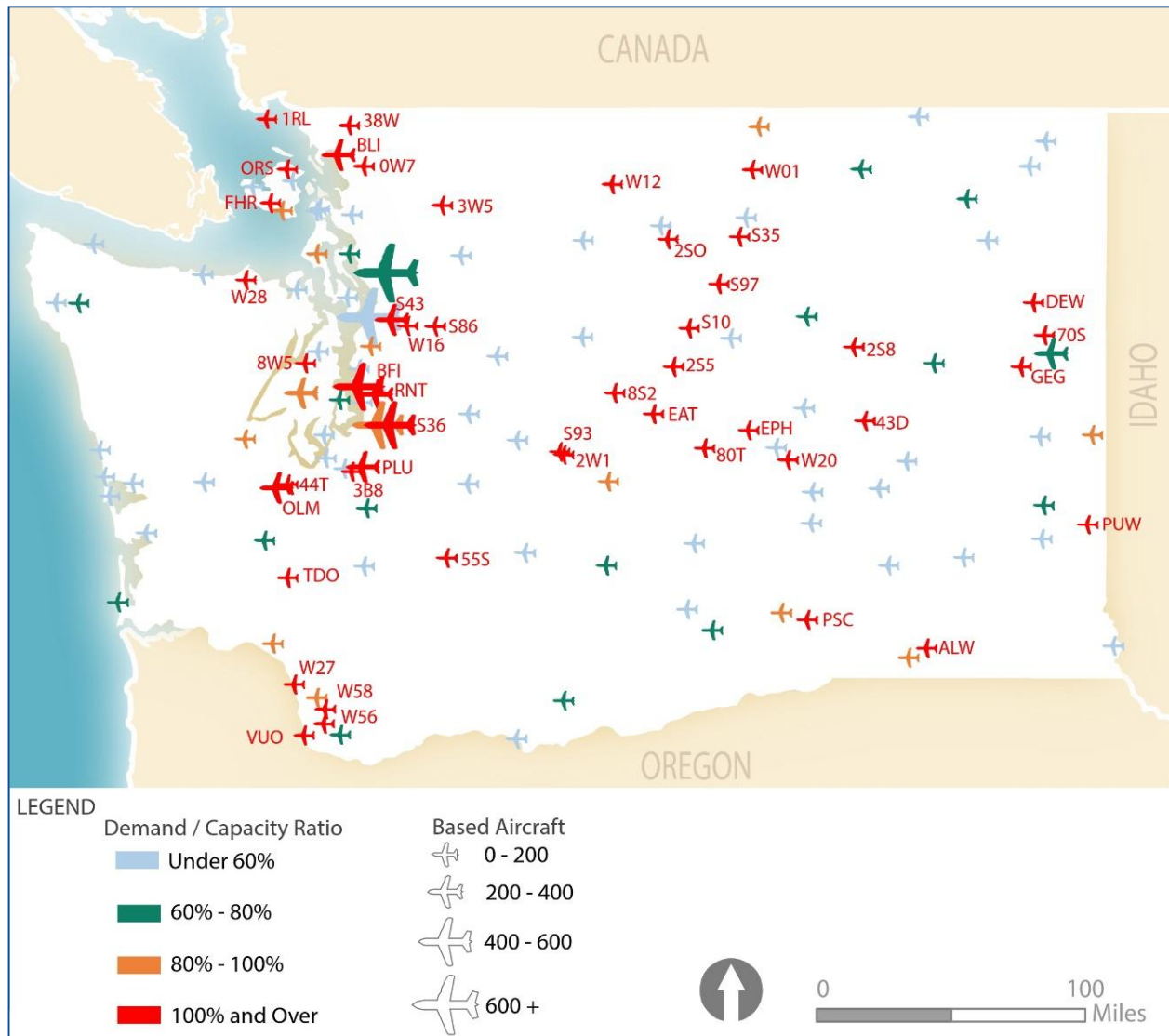


Table 5-5: 2034 Statewide Aircraft Storage Capacity Shortfall, by number of storage positions

Airport Name	Classification	Total 2034 Demand	2014 Capacity	Expected 2034 Shortfall
Crest Airpark	Community	474	233	-241
Bellingham International	Major	295	199	-96
Boeing Field/King County International	Major	499	418	-81
Orcas Island	Community	142	94	-48
Apex Airpark	Community	96	68	-28
Tri-Cities	Major	170	143	-27
Pierce County/Thun Field	Regional	357	337	-20
First Air Field	Community	106	87	-19
Moses Lake Municipal	Community	80	61	-19
Olympia Regional	Regional	206	187	-19
Cashmere Dryden	Community	50	36	-14
Mears Field	Community	66	54	-12
Sequim Valley	Community	50	39	-11
Lynden Municipal	Community	37	27	-10
Walla Walla Regional	Major	145	135	-10
Ed Carlson Memorial – South Lewis County	Community	51	42	-9
Okanogan Legion	Community	26	17	-9
Twisp Municipal	Community	44	35	-9
Point Roberts Airpark	General Use	9	1	-8
Deer Park Municipal	Regional	124	117	-7
Mead Flying Service	Community	30	23	-7
Fly For Fun	General Use	12	6	-6
Woodland State	Community	23	17	-6
Cedars North Airpark	General Use	8	3	-5
Floathaven SPB	General Use	8	3	-5
Friday Harbor	Regional	188	183	-5
Pangborn Memorial	Major	135	130	-5
Renton Municipal	Regional	363	358	-5
Wilbur Municipal	Community	12	7	-5
Lost River	General Use	5	1	-4
Odessa Municipal	Local	11	7	-4
Anderson Field	Community	19	16	-3
Harvey Field	Regional	285	282	-3

Airport Name	Classification	Total 2034 Demand	2014 Capacity	Expected 2034 Shortfall
Pullman-Moscow Regional	Regional	76	74	-2
Shady Acres	Community	50	48	-2
Tonasket Municipal	Community	27	25	-2
Packwood	Local	4	3	-1
Spokane International	Major	75	74	-1
Cle Elum Municipal	Local	5	5	0
DeVere Field	Local	5	5	0
Ephrata Municipal	Regional	80	80	0
Hoskins Field	General Use	8	8	0
Lake Chelan	Community	68	68	0
Pearson Field	Regional	171	171	0
Quincy Municipal	Local	6	6	0
Sky Harbor	General Use	3	3	0
Waterville	Local	13	13	0

Source: WSP / Parsons Brinckerhoff

5.4 Air Cargo Capacity

At the airport level, efficient infrastructure investment translates to the improvement of connectivity, efficiency, cost, and service.

The essential components that are basic to cargo operations include the cargo building for the transfer of cargo from landside to airside, parking and docking to accommodate landside vehicles, and the aircraft ramp for parking aircraft and airside handling of cargo. The cargo building, in addition to acting as a transfer point for cargo passing to and from airside to landside handlers, may also be used for warehousing and storage, container makeup and breakdown, and package sorting operations.

Other facilities related to air cargo may include access roads; truck marshalling areas; aircraft taxilanes and maneuvering areas; and landside offices and warehouse facilities for cargo support groups, such as forwarders, brokers, and national inspection agencies. Configuration and space allotted for access roads, truck marshalling areas, aircraft taxilanes, and aircraft movement areas are site dependent, while landside offices and facilities for cargo support groups are tenant dependent.

5.4.1 Overall Cargo Facilities Planning Concept

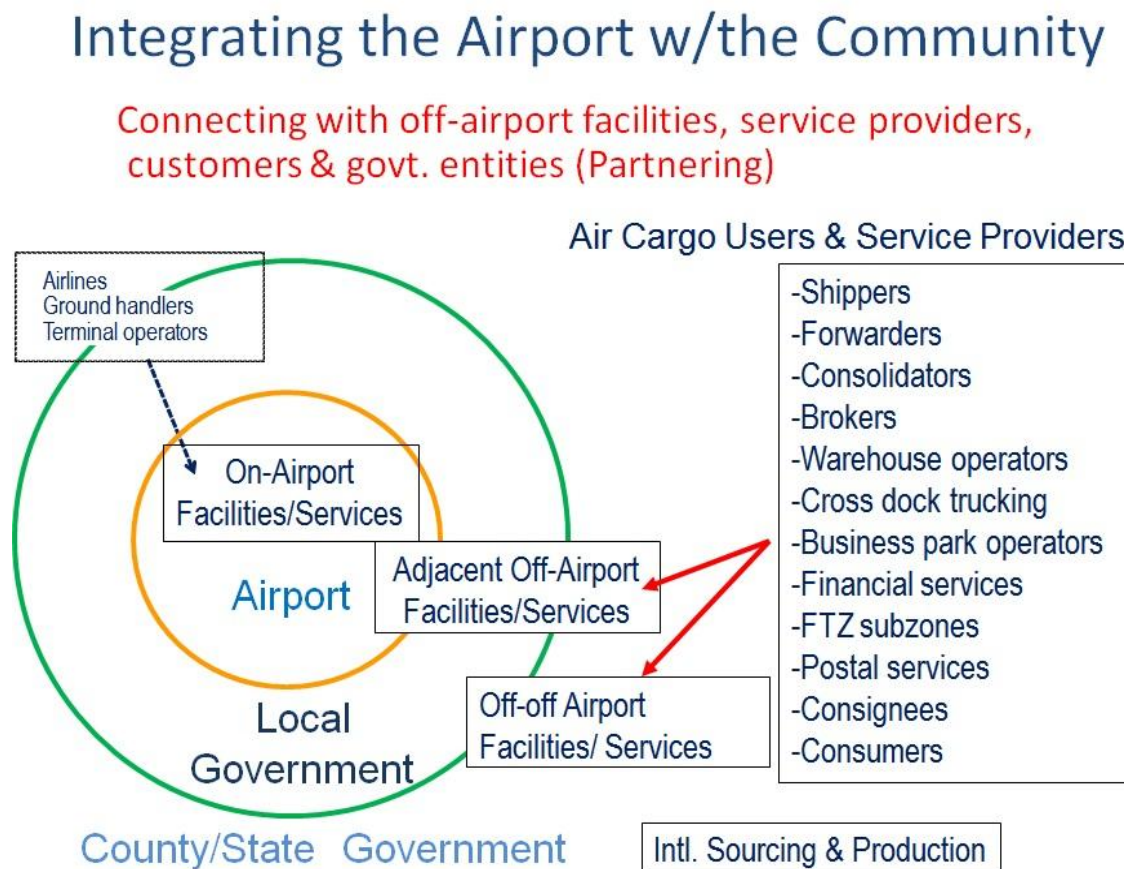
Airports and airlines are only a part of a larger eco-system of support services and facilities that comprise the air cargo supply-distribution chain. An airport can be thought of as a key intersection between air logistics and real estate.

Efficient logistics requires strong and visible connectivity made possible through the elimination of as many friction areas as possible. In today's new globally competitive business environment, product

obsolescence rates, life cycles, and fast-cycle time inventory models are primary drivers for deciding where to locate today's distribution centers and third-party logistics services. For time-critical deliveries and high-value internationally traded commodities, cost-efficient access to airports and air cargo facilities is increasingly crucial.

Figure 5-8 illustrates a schematic of the relationship between on-airport air cargo activity and second line and off-airport services and facilities.

Figure 5-8: Integrating the Airport with the Community



Due to limited on-airport land availability and higher prices, a significant portion of the air cargo logistics chain activity takes place outside the immediate airport boundaries. However, since transportation costs can be significantly larger than real estate costs, and due to congestion-related uncertainty in travel times, many users of air cargo want to be as close as possible to the airport.

Being close to an airport allows third party logistics providers, particularly freight forwarders, consolidators, and pick-up and delivery services, the ability to dependably offer later drop-off times for shippers to their facilities and provide earlier delivery times to the consignee.

As one moves up the supply chain and closer to the manufacturer, location to the airport becomes less critical.

5.4.2 Washington State Air Cargo Facilities

Air cargo activity in Washington State is highly concentrated primarily occurring at Seattle/Tacoma International Airport (SEA), King County International Airport (BFI), and Spokane International Airport (GEG). Non-hub and small commercial passenger airports within the state account for only 4 percent of the total air cargo volumes moved in 2014. By the year 2034, the market share of air cargo for non-hub airports is expected to shrink to 3.6 percent.

Seattle-Tacoma International Airport

As stated previously, air cargo in Washington State is primarily generated by activity at SEA. Over the past five years (2009–2014) SEA has averaged a 3.9-percent growth rate in total air cargo tonnage. During 2014, the amount of air cargo handled at the airport increased by 11.8 percent.

Based on a Martin Associates 2013 *Economic Impact of the Port of Seattle*, air cargo activity at SEA provides the region a \$22.7-billion economic value. It is responsible for 119,685 related jobs, \$5.5 billion in wages and salaries, and \$520.7 million in state and local taxes. Freighters landing fees at SEA contributed approximately \$5.5 million, effectively reducing the cost per enplanement at SEA by \$0.29. More importantly, as described in Chapter 2, the air cargo service provided at SEA provides not only Seattle regions, but Washington State and the entire Pacific Northwest with access to both domestic and global markets.

Existing air cargo facilities at SEA are comprised of 12 total on-airport cargo warehouses interspersed throughout a ramp area on the north end of the airport that primarily serve as “pass-through” facilities. There are 17 cargo area freighter hardstands for widebody aircraft. There is also a 58,000-square-foot lower-deck cargo (belly cargo) facility on the southeast side of the airport.

A capital improvement project is underway to expand the cargo aircraft parking areas to accommodate the increasing frequency and use of the Group VI Boeing 747-8 nose load freighters.

Air cargo facility requirements at SEA are problematic due to the limited amount of land available for development and the significant growth in both passengers and cargo over the past five years.

SEA is currently in the later stages of its 20-year *Sustainable Airport Master Plan (SAMP) Update*. The SAMP air cargo assessment identified inefficient configuration of existing cargo facilities. However, in the list of development priorities in the SAMP, the provision of adequate resources for air cargo ranks 4th on a list below the airport passenger terminal, the airport airfield, and landside business and roadway development.

The most recent SAMP briefing (July 16, 2016) indicated that a number of airport development alternatives would result in a decrease in air cargo parking positions. Compounding the seriousness of a lack of existing air cargo resources is that the SAMP air cargo forecast is considered by some to be extremely conservative, and actual 2016 cargo volumes have already exceeded the SAMP forecast. Therefore, the ability of SEA to accommodate future Washington State air cargo demand is in doubt.

King County International Airport

As a primary gateway for UPS, BFI generates the second largest volume of air cargo in the state of Washington after SEA. In 2014, UPS accounted for 80 percent of the air cargo tonnages at BFI with the next largest air cargo carrier, ABX Air, operating on behalf of DHL, accounting for approximately 12 percent of the 2014 tonnages.

According to the *Draft King County International Airport Master Plan Update* (May 2016), air cargo freight and mail facilities are currently concentrated at three areas along the east side of the airport property. The first area, located in and adjacent to the passenger terminal, is associated with AIRPAC Airlines that leases space in the north end of the terminal building and adjacent apron area. The second cargo area (utilized exclusively by UPS and Ameriflight) is located just south of the terminal and consists primarily of apron area, accommodating parking positions for four large air carrier aircraft and several smaller aircraft, as well as a variety of small storage/office buildings and vehicle parking/cargo transfer areas. The third cargo area is located farther to the southeast (adjacent to the Runway 31R threshold) and consists primarily of apron area, accommodating parking positions for two large air carrier aircraft, as well as a storage/office building and vehicle parking/cargo transfer areas.

Since June 2016, ABX/DHL has moved its air cargo operations from BFI to SEA. The move will reduce the air cargo activity at BFI by about 20 flights per week of Boeing 757 and B767 freighter aircraft.

From a review of the *Draft King County International Airport Master Plan Update* (May 2016) and the *King County International Airport Strategic Plan 2014–2020*, and a comparison of available facilities at the airport, it was determined that there exists sufficient land and runway capacity available to accommodate future air cargo demand at the airport.

Spokane International Airport

Existing air cargo facilities at GEG are located within the terminal area west of Runway 3-21. These facilities include cargo terminals, cargo aircraft apron and weigh scales, administration, freight forwarding and sort building space, landside vehicle access, and parking facilities. Total building space is approximately 61,983 square feet.

A 26,400-square-foot joint-use building accommodating the passenger carriers belly freight is located north of the airport passenger terminal building. The building consists of administrative office space, landside-loading docks, and short-term heated storage areas for each carrier. The building is rectangular in shape with approximate dimensions of 80 feet wide by 330 feet long. A paved area on the immediate southeast side of the building, measuring approximately 80 feet by 320 feet, provides approximately 25,600 square feet for the tugs and dollies transporting belly freight from the passenger terminal and for freight consolidation. A vehicle parking lot, located on the northwest side of the building, measures approximately 125 feet by 320 feet, or 40,000 square feet in area.

Two single-user cargo buildings adjacent to each other are located within the terminal area, northeast of the joint use facility. The larger of the two building is 20,463 square feet, while the smaller is 11,600 square feet with a 3,000-square-foot annex. The area is served by approximately 463,533 square feet of cargo apron.

East of the runways exists over 80 acres of land available for future airside development.

Based on the available resources at GEG, there should not be any issues for the airport to accommodate future air cargo demand.

Non-hub Airports

As mentioned previously, air cargo activity at small commercial service airports in Washington State is generated almost exclusively by FedEx and UPS with very small quantities of enplaned and deplaned belly cargo by Alaska/Horizon Airlines. Belly cargo capacity at smaller airports in the state is limited due to the regional aircraft utilized to serve these markets.

Beyond space for FedEx and UPS airport operations, the need for airport air cargo facilities at most non-hub commercial service airports in Washington State is limited. Air cargo tendered at these airports is typically same day express cargo under 150 pounds in weight. Most of these small packages have limited dwell time.

An exception to this profile is Snohomish County Paine Field. The surge in air cargo at Paine Field in 2014 was generated by special modified widebody freighters as a part of the Boeing Company's 787 airplane manufacturing and assembly program. Origin and destination cities for cargo generated at Paine Field included Anchorage (a trans-Pacific transload point), Charleston, Nagoya, and Wichita. The general cargo demand in Snohomish County is served through SEA and BFI.

5.5 Summary and Findings

SEA dominates the Washington State air cargo market with a mix of domestic and international belly cargo, domestic and international freighter cargo, as well as integrator/express cargo generated by FedEx and DHL.

Air cargo activity at SEA provides the region a \$22.7-billion economic value. It is responsible for 119,685 related jobs, \$5.5 billion in wages and salaries, and \$520.7 million in state and local taxes.

However, the ability of SEA to accommodate and expand air cargo activity, particularly international freighter service, may be in jeopardy due to an under estimation of demand and the aggressive expansion of air passenger and maintenance, repair, and overhaul activities.

The analysis found no evidence of constraints to air cargo activity at other Washington system airports.

GEG and BFI are projected to experience moderate growth in air cargo demand and have adequate resources to accommodate future air cargo growth.

Snohomish County, Pasco, Yakima, Bellingham, Wenatchee, Moses Lake, Port Angeles, and Skagit all have relatively small cargo operations and on-site capacity does not seem to be an issue.